

From: [Foley, Patrick](#)
To: [Pierce, Jennifer](#)
Cc: [Froikin, Sara](#); [Spina, Providence](#)
Subject: Flare Rainout at Limetree Refinery
Date: Thursday, May 13, 2021 3:10:25 PM
Attachments: [Flare.Hazards.xv-paper-15.pdf](#)
[Flare.Knockout.Drum.ENGINEERING-DESIGN-GUIDELINES-flare-knockout-drum-Rev1.1web.pdf](#)

Jennifer,

You had asked me to explain my concern with flare rainout that has happened at least twice now at the Limetree refinery since February 2021 and as recently as yesterday. In the paragraph below please find my assessment of the hazards and risks of flare rainout and how it can be avoided through proper design and operation. To the best of my professional knowledge, experience and expertise in this technical area, the below information is accurate.

Emissions of oil droplets from a flare is called "flare rainout." Flare rainout can create both environmental and physical safety hazards. Oil contamination of soil and water bodies creates environmental and public_health_hazards. Flare rainout can also result in physical and safety hazards such as "flaming rain" where the oil droplets ignite as they pass through the flare flame and rain down while on fire in the refinery and nearby neighborhoods, creating sources of ignition for vapors in the refinery and igniting combustible materials and starting fires inside the refinery and in adjacent neighborhoods. Because of these concerns, flare systems are designed with process vessels called "knockout drums." Knockout drums are vessels whose function is to remove or "knockout" liquid droplets from the gas sent to flare. Knockout drums are sized for expected maximum load of liquid droplets. When that capacity is exceeded, the liquid droplets pass through the knockout drum and can cause flare rainout and flaming rain.

I have attached two references that I consulted in developing this response.

Patrick Foley
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